EOCR-iSEM

Main Features

EOCR-iSEM

- Monitors active/reactive power and electric energy (integrated)
- Records fault waves (200ms): Records 3-phase current and 3-phase voltage, and saves the data
- Measures electrical energy through 4~20mA output contacts (+, -)
- Motor insulation status check: Can select from standard insulation resistances of 1MΩ, 5MΩ, and 10MΩ, and diagnose if it is higher or lower than the reference value (diagnosable while motor has stopped running)
- 3-phase current measurement: 0.5~100A with the use of a built-in CT, 100~960A with the use of an external CT
- Allows earth fault protection with the built-in ZCT without having to connect to an external ZCT (0.03~10A)
- The date and time can be checked during a power outage with the Date/Time settings (y/m/d/h/m/s)
- Various protection methods: Definite, Inverse, and Thermal Inverse
- Protects against earth fault current and short-circuit simultaneously (50msec)
- Communication function: MODBUS RS-485
- Records information of the last 3 faults: Fault type, fault current, and fault date/time
- Security settings function (password function)
- Bar Graph display function: Capable of checking the ratio of operating current vs set current
- Restart limit function, operation time setting and display
- Provides software that enables the operator to perform setting and monitoring through a PC

Protection Functions

Protected Items		Operation Conditions & Setting Range	Operation Time
Electric Current Element	Over Current	Operates if electrical current higher than the set current continues over the operation time (ot). Over current Definite: 0.5~100A Inverse/Thermal Inverse: 0.5~60A	Definite: Can be set from 0.2~120 sec, Thermal Inverse/Inverse: 1~30 Class
	Under Current	Operates if electrical current lower than the set current continues over the operation time (ut). Factory setting up to 0.5~oc set value or less	Definite: Can be set from 0.5~120 sec (operates in Definite even if Inverse is selected)
	Phase Loss	Operates if the phase-to-phase current deviation is 85% or more. On/Off selectable.	Can be set from 0.5~5 sec
	Stall	Operates if electrical current higher than the set current at the time the motor is running continues beyond the startup delay time (dt). Stall is applied only if a motor starts, and is set as a multiple of the over current (oc) set value. Sc value can be set when oc × Sc <= 500A or less.	Within 0.5 sec after D-Time Does not operate if D-Time is set to "0"
	Jam	Operates if the electric current higher than the set current continues over the operation time (St) due to a rapid load increase during motor operation. JA value can be set when oc × JA <= 500A or less.	Can be set from 0.2~10 sec (operates in Definite)
	Unbalance	Operates if the phase-to-phase current deviation unbalance rate is over the set value. Can be set from 10~50%. Unbalance rate=(max. phase current - min. phase current) / max. phase current x 100%	Can be set from 1~10 sec
	Reverse Phase	Operates if the sequence of current phase is reversed. On/Off selectable.	Within 0.15 sec
	Earth fault current *1)	Operates if an earth fault current higher than the value of earth fault current set with zero-phase current detected by ZCT continues over the operating time (Et). oFF, 0.03~2.5A (when EF: 2.5 is selected) or 1.0~10A (when EF: 10 is selected)	Can be set from 0.05~10 sec (External) Can be set from 0.1~10 sec (Internal)
	Earth fault current *1)	Operates if the earth fault current higher than the set earth fault current is entered. SH value can be set when oc × SH <= 500A or less.	Within 0.05sec
Voltage Element	Over Voltage	Operates if the voltage higher than the set voltage continues over the operation time (ovt). Can be set from 101~115% of the nominal voltage (110~690V)	Can be set from 0.2~30 sec
	Under Voltage	Operates if a voltage lower than the set voltage continues over the operation time (uvt). Can be set from 70~99% of the nominal voltage (110~690V) (operates at 80% or higher of the nominal set voltage)	Can be set from 0.2~30 sec
	Voltage Phase Loss	Operates if the phase-to-phase voltage deviation is 38% or more. On/Off selectable.	Can be set from 0.1~30 sec
	Voltage Unbalance	Operates if the phase-to-phase voltage unbalance rate is greater than the set value. The unbalance rate, which can be set from 3~15% = (max. difference between phase-to-phase voltage and average phase-to-phase voltage) / (average phase-to-phase voltage) x 100%	Can be set from 0.2~20 sec
	Reverse Phase	Operates if the sequence of pull-in voltage is reversed. On/Off selectable.	Within 0.15 sec
Electric Power Element	Overpower	Operates if power higher than the set power continues over the operation time (opt). Can be set from 20~800% of the nominal voltage (0.1~999kW) (does not operate during motor operation)	Can be set from 1~100 sec
	Low Power	Operates if voltage lower than the set voltage continues over the operation time (upt). Can be set from 20~800% of the nominal voltage (0.1~999kW) (does not operate during motor operation)	Can be set from 1~30 sec
	Overpower Factor	Operates if a power factor higher than the set power factor continues over the operation time (oft). Can be set from 0~100% (does not operate during motor operation)	Can be set from 2~30 sec
	Low Power Factor	Operates if a power factor lower than the set power factor continues over the operation time (uft). Can be set from 0~100% (does not operate during motor operation)	Can be set from 1~30 sec

**1) This function is not available in iSEMD products.*

Secondary Functions

Function	Description
Password Setting	Allows you to set a password so that no one except the manager can change the setting.
3-phase/Single-phase Selectable	Can be used on 3-phase or single-phase motor based on the manager's selection, without any further operations.
Operation Characteristics Selection	Definite/Inverse/Thermal Inverse can be selected and used depending on the motor usage environment.
Earth Fault Operation Delay Time Setting *1)	Allows you to set a delay time for earth fault operation during operation to prevent an earth fault malfunction caused by operating current or harmonic waves occurring at the time of start-up.
Short-circuit Operation Delay Time Setting *1)	Allows you to set a delay time for short-circuit operation during operation to prevent a short-circuit malfunction caused by operating current or harmonic waves occurring at the time of start-up.
Analog (+, -) Output Setting *1)	With LC selected, analog output of 4~20mA can be used. With PS selected, it is possible to remotely measure electric energy through metering pulse.
Start Cycle Setting	The motor status is determined by comparing the start delay time (dt) set by the user with the current value of the motor. If the motor is set to start with the Star-Delta setting, current that falls to the Off level or below while being converted from Star to Delta will be ignored, and the motor's state will be determined as a starting state.
Selecting Fail Safe	This is an optional function that can be used to check the operating power supply of EOCR and faults on EOCR.
Alert Function Selection	This function allows the prevention of trip by generating a pre-alarm output before being operated by over current. A user may choose his or her preferred alarm output behavior from the list on the table of alert output behaviors.
Insulation Resistance Value Selection *1) *2)	Allows you to diagnose the motor insulation status when the motor stops, and the reference value can be set to 1MΩ, 5MΩ, or 10MΩ.
Selecting Reset Method	Can choose from manual/auto/electrical reset.
Operation Time Setting	An alert output is generated if cumulative operation time exceeds the time set for user's maintenance. Time can be set from 1~9990 (in hours).
Saving Total Operation Time	The total operation time is accumulated every time the motor operates, and the hours of use until the moment will be displayed. The user cannot reset this value because it can be reset in the manufacturing process only. The max. display time is 99999, and beyond this value, it starts to accumulate from 0 all over again.
Date/Time Setting	Allows you to accurately identify the time of motor failure by saving the date and time of the fault.
Restart Limit Function	Limits the number of attempts to reset the motor within 30 minutes if auto reset is enabled.
Fault Wave Record Save (can only be checked through communication)	Fault wave record saves the sample values during 200ms for 3-phase current and voltage inputs when a fault occurs. The sampling is processed in 1ms increments. The data (70%) in the first half of the fault wave record are sample values before the trigger, while 30% in the second half shows the sample values after the trigger.
Self Test Function	It is possible to use the self-test function under the condition in which the load current is not supplied to the motor. This function is executed by selecting the "TEST" menu. The self test function counts down the over current operation duration time (ot) during which the Watchdog and Ram check are simultaneously tested.
Checking Communication Status	Generates an alert if there is no communication during the time set by the user after checking the communication status between external PLC/DCS and iSEM. Time can be set from 1 to 999 sec.

**1) This function is not available in iSEMD products.*
**2) This function is not available in iSEMZ products.*

Communication Function

Items	Specification	Notes
Communication Protocol	Modbus RTU	
Communication Method	RS-485	
Communication Speed	1.2, 2.4, 4.8, 9.6, 19.2, 38.4kbps	
Communication Distance	Max. 1.2kM	Depends on usage environment
Communication Line	Universal RS-485 Shielded Twist 2-Pair Cable	

Specifications

Over Current Setting Range (oc)		Definite: 0.5~100A Inverse/Thermal Inverse: 0.5~60A
Under Current Setting Range (uc)		Under the set value of 0.5~oc or less, or Off
Overload Characteristic Curve (tcc)		Definite (Def)/Inverse (Inv)/Thermal Inverse (th)
Leakage Earth Fault Current Setting Range (Ec)		Off, 0.03~2.5A (when 2.5 is selected) or 1.0~10A (when 10 is selected)
Multiple of Short-circuit Current Setting (SH)		2~50 times (SH value can be set when oc × SH <= 500A or less)
Stall (Sc)		2~8 times (Sc value can be set when oc × Sc <= 500A or less)
Jam (JA)		1.5~8 times (JA value can be set when oc × JA <= 500A or less)
Current Operation Time Characteristics	Start Delay Time (dt)	0~600s
	Over Current Operation Time (Definite, ot)	0.2~120s
	Over Current Characteristic Curve (Inverse, cls)	1~30 Class
	Under Current Operation Time (Definite, ut)	0.5~120s
	Leakage Earth Fault Current Operation Time (Et)	0.05~10s (External), 0.1~10s (Internal)
	Leakage Earth Fault Delay Time at Start-up (Edt)	0~30s
	Short-circuit Current Operation Time	Within 0.05s
	Short-circuit Delay Time at Start-up (Sdt)	0~20s
	Jam Operation Time (Jt)	0.2~10s
	Phase Loss Operation Time (Plt)	0.5~5s
	Unbalance Operation Time (Cut)	1~10s
	Reverse Phase Operation Time	Within 0.15s
	Auto Reset Time	0.5 sec~20 min
	Reset Type	Manual (H-r)/Remote (E-r)/Auto (A-r)
Over Voltage Setting Range (ov)		101~115% (Nominal Voltage: 110~690V)
Under Voltage Setting Range (uv)		70~99% (Nominal Voltage: 110~690V)
Voltage Operation Time Characteristics	Over Voltage Operation Time (ovt)	0.2~30s
	Under Voltage Operation Time (uvt)	0.2~30s
	Phase Loss Operation Time (Vlt)	0.1~30s
	Unbalance Operation Time (Vut)	0.2~20s
	Reverse Phase Operation Time	Within 0.15s
Overpower Setting Range (op)		20~800% (Nominal Power: 0.1~999kW)
Low Power Setting Range (up)		20~800% (Nominal Power: 0.1~999kW)
Power Operation Time Characteristics	Overpower Operation Time (opt)	1~100s
	Low Power Operation Time (upt)	1~30s
Overpower Factor Setting Range (of)		1~100
Underpower Factor Setting Range (uf)		1~100
Power Factor Operation Time Characteristics	Overpower Factor Operation Time (oft)	2~30s
	Underpower Factor Operation Time (uft)	1~30s
Control Power	Rated Voltage	100~240VAC, 24VDC
	Frequency	50/60Hz
	Power Consumption	8VA or less
System Voltage		3-phase, AC 110~690V, 50/60Hz
Output Contact	Capacity	3A/250VAC Resistive.
	Configuration	Over Current: 1a1b, Earth Fault Current: 1a, Short-circuit Current: 1a, Alert: 1a
Display Function	7-segment LED	Displays current, voltage, earth fault current, active/reactive power, electric energy, operation time, total operation time, power factor, fault cause, set value, and set items
	Bar graph	Displays load factor (65~100%)
Communication Method		Modbus-RTU/ RS-485
Current Loop Communication		Converts and outputs the max. phase current of the 3-phase current to 4~20mA
Attachment Method		Embedded Panel (Flush Mounting)
Insulation Resistance	Between the circuit and case	DC500V 10MΩ or higher
	Between the insulation withstanding voltage circuit and case	2KV, 50/60Hz, 1 min
	Between contacts	1KV, 50/60Hz, 1 min
	Between circuits	2KV, 50/60Hz, 1 min
Electrostatic Discharge (ESD)	: IEC61000-4-2 / IEC60255-22-2	Level 3: Air Discharge: ±8KV, Contact Discharge: ±6KV
Radiated Disturbance	: IEC61000-4-3 / IEC60255-22-3	Level 3: 10V/m, 80~1000MHz
Conducted Disturbance	: IEC61000-4-6 / IEC60255-22-6	Level 3: 10V, 0.15~80MHz
EFT/Burst	: IEC61000-4-4 / IEC60255-22-4	Level 3: ±2KV, 1 Min
Surge	: IEC61000-4-5 / IEC60255-22-5	Level 3: 1.2 x 50μs, ±4KV (0°, 90°, 180°, 270°)
Emission	: CISPR11 / IEC60255-22-26	Class A (Conducted and Radiated)
Usage Environment	Temperature Storage	-40℃~+85℃
	Operation	-20℃~+60℃
	Humidity	30~85% RH (with no dew condensation)
Dimensions	Main body EU	90.3W x 52.1H x 108.1D
	Display sPDM	72W x 72H x 28.1D
Weight		iSEMD: 422g, iSEMZ: 450g, iSEMM: 454g
		sPDM: 125g, 1M cable: 55g

Uses the Over Current Operation Time Characteristic Curve of the iEOCR-MME Catalogue

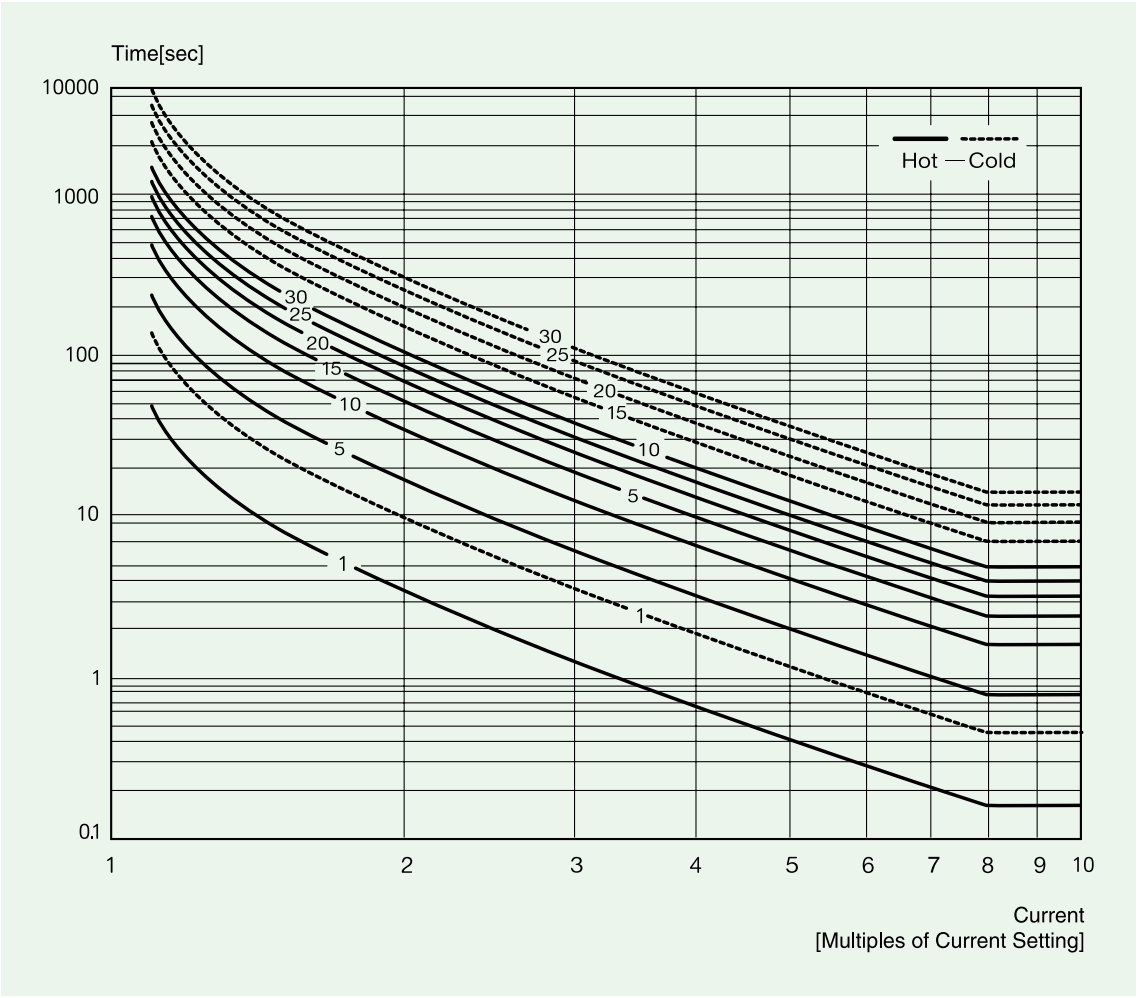


Table 1. Over Current Protection Inverse Operation Characteristics (0.5~60A)

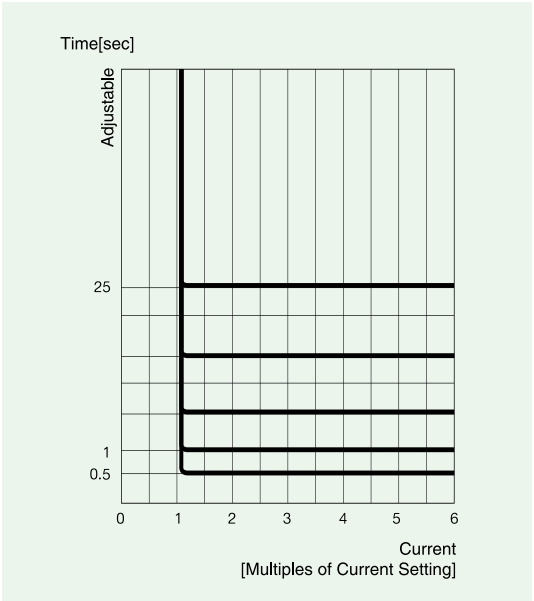


Table 2. Over Current Protection Definite Operation Characteristics

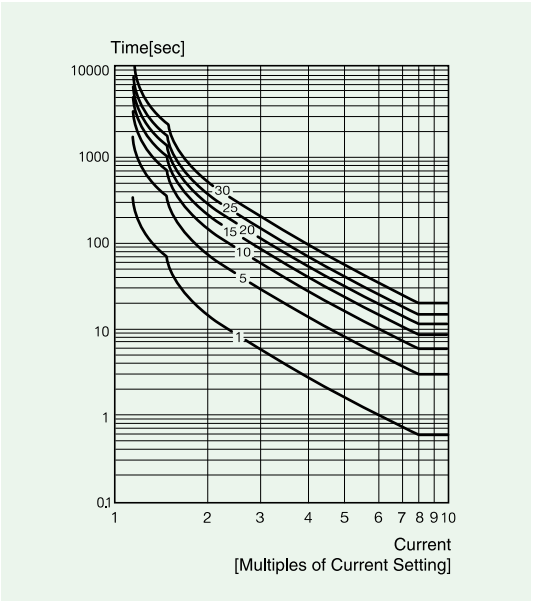


Table 3. Over Current Protection Thermal Inverse Operation Characteristics (0.5~60A)

How to Set Current/Time

- **Over Current Protection**

Settings for Definite

1. Current Setting: Set it on the rated current displayed on the motor nameplate, but to protect the machine as well as the load, it must be set to 110~120% of the operating current when its load level is normal after starting up.
2. Start Delay Time (D-Time): Set the expected start time of the motor. If you are unsure of the start time, set it to 15 sec, start the motor, measure the time it takes for the current (shown on the display window) to change from start current to normal operating current, and change the time to a value that is about 2 seconds longer than the measured start time. If it is the Y-D starter, add 2 sec to the timer set time to allow for the change from Y start to Delta. For loads with a greater inertia, such as Blower (AHU), you may have to set the time even longer depending on the start condition.
3. Operation Time (O-Time): Set the time it takes from the moment the current exceeding the set value starts to flow until the relay begins to operate.

Settings for Inverse or Thermal Inverse

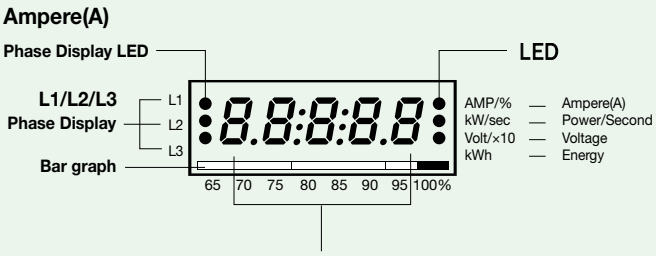
1. Current Setting: Set it on the rated current displayed on the motor nameplate.
2. Start Delay Time (D-Time): There is no need to set the start delay time when using Inverse, but the start time will be delayed. If you want a faster operation time when there is over current flow during the operation, set the D-Time. During the D-Time, the over current will not operate but will be delayed instead, just as in the case of Definite, and after the set time, it will operate using the Hot Curve. For this reason, if there is over current, you may select Curve for faster operation. If you select Thermal Inverse, the operation time will be determined according to the calculated thermal accumulation, regardless of the start delay time setting. Thus, if Thermal Inverse is used, there is no need to set D-Time.
3. Operation Time (O-Time): When using Inverse characteristics, this indicates the operation curve, not the operation time. You may choose the curve from 1 to 30, and this is the operation curve that matches the IEC standard. Also, the operation curves such as 1, 5, and 10 are the times that match operation time on Cold Curve when the current flow has reached 550% of the set current. This can be referenced during the setting.

Alert Operation Characteristics Table

Load Status / ALo Setting	In Operation	Normal operation	Operation Status at the Current specified in the Alert Setting or higher	Trip
Aux “A”				
Flicker “F”				
Hold “H”				
Time Out “to”				
Under Current “uc”				
Insulation Resistance “In”				
MC Count “mc”				
Voltage “Vo”				
Power “Po”				

Product Display Front View

A digital 3-phase current/voltage system function that displays the operating current and phase-to-phase voltage of the 3 phases on the 5-digit, 7-segment digital monitor on the front panel of sPDM together with the phase display, the display of which automatically circulates every 2 seconds.



7-segment LED

A large font and a comfortable background color are used to prevent visual interference caused by reflections from the control panel in any direction.

Bar graph

- Allows you to see the load status of the motor by showing the present ratio of the operating current to the OC (Over Current) protection set value.
- If you set the OC set value to the rated current of the motor, the percentage (%) shown on the bar graph will indicate the load factor of the motor.
- Shows the current ratio of the present flow to the set value of the over current. i.e., % = (present current / set value of OC) × 100%
- Current below 65% will not be displayed.
- For example, if you specified the OC setting as 4.5A and the current flow is 3.6A, up to 80% of the LED bar graph will illuminate, but it will not if the current is 2.92A or less. If the current flow is 4.5A or higher, up to 100% (red) of the LED bar graph will illuminate to indicate an overload status.

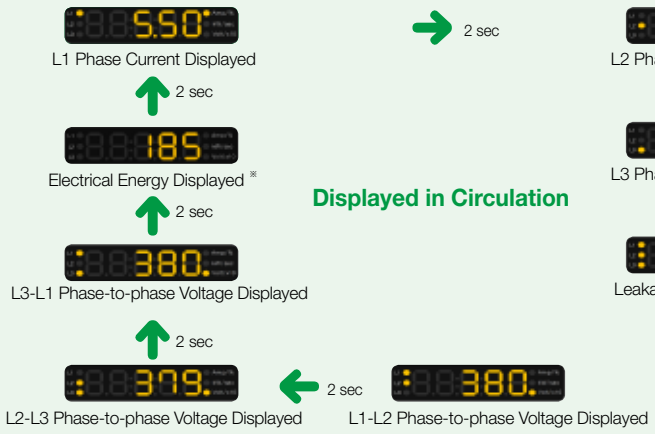
Display of Each Phase

- Displays the phase with the highest current in the event of OC, Stall, or Jam
- Displays the phase with the lowest current in the event of under current or current unbalance
- Displays the lost phase during the phase loss operation
- Displays the relevant phase if over voltage, under voltage, or voltage unbalance occur
- Displays phases during operation, the current of each phase, and phase-to-phase voltage

Unit Display

- Amp/%: Amp/% LED will be ON when setting current/voltage/power and displaying current.
- kW/Sec: kW/Sec LED will be ON when displaying power and setting time while displaying time in seconds (s).
- Volt/x10: When the voltage display and the current to display reach 999 amperes or higher, the LED will be ON to indicate the flow of 10 times more current. It is set to the interval of every 10 hours when setting the operation time, during which Volt/x10 LED will be ON.
- kWh: kWh LED will be ON when displaying the total electrical energy.

Display Function of Digital 3-phase Current, Voltage, and Electric Energy



※ *If you press the SET button once during operation, the display will change to a manual circulation display instead of an auto circulation display. Once in manual circulation mode, every time you press the SET button, the display will rotate in the abovementioned sequence, making intensive monitoring possible if necessary by fixing on the current and voltage of a specific phase.*
※ *In manual circulation mode, if you press the ESC button once, it will switch to auto circulation display mode.*
※ *However, for ISEMD products, the leakage current display is not available.*
※ *Electrical energy display can be turned on/off by setting it in advance (refer to dSP menu)*

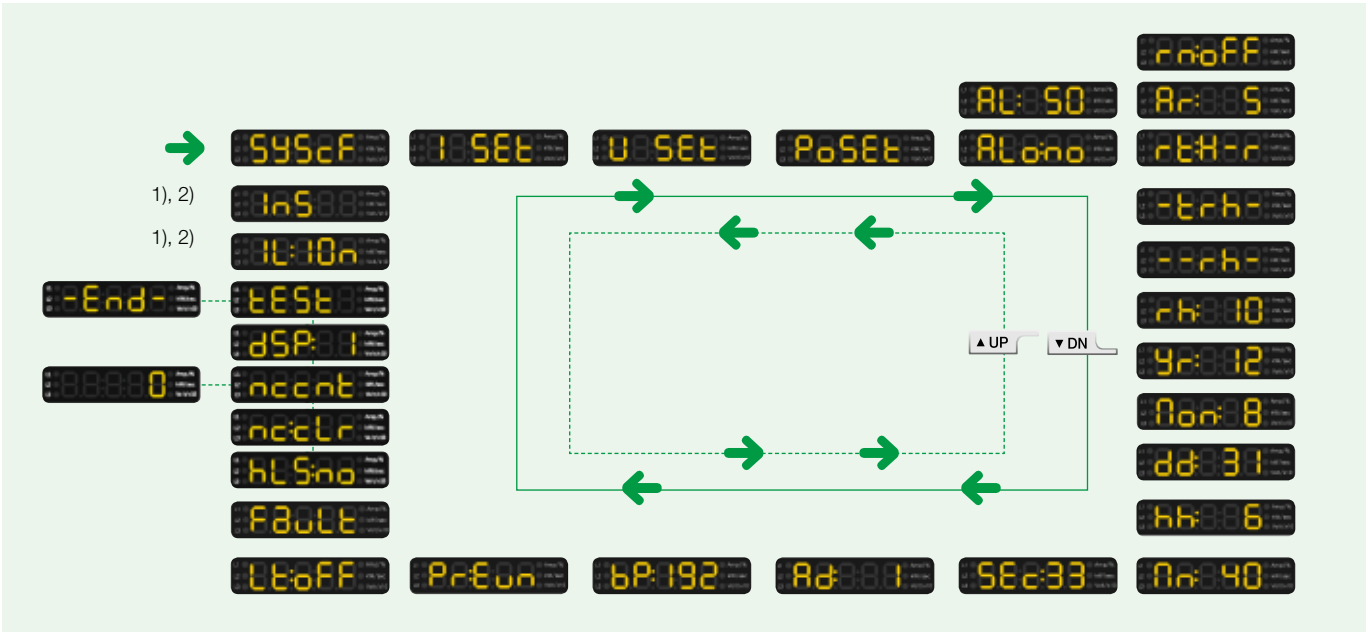
Button Switch Functions and Setting Sequence

Button Display	Function
▲ UP ▼ DN	Press the UP or DN button to find the menu you want to set. For menus, see the descriptions on setting sequence and display.
SET	Press the SET button once to send a signal to the relay that notifies it that the setting process will begin. Then, the number or characters you want to set will start to flicker. This indicates that you can now change the setting.
▲ UP ▼ DN	Press the UP or DN button to find the number or characters you want to set.
SET	If the characters or number you want to set is displayed, press the SET button for the relay to save it. The character or number then stops flickering. This indicates that the setting has been saved.
ESC	Press the ESC button to return to the current display. If you do not press ESC button for over 50 seconds after the setting is made, it will automatically return to the current display.

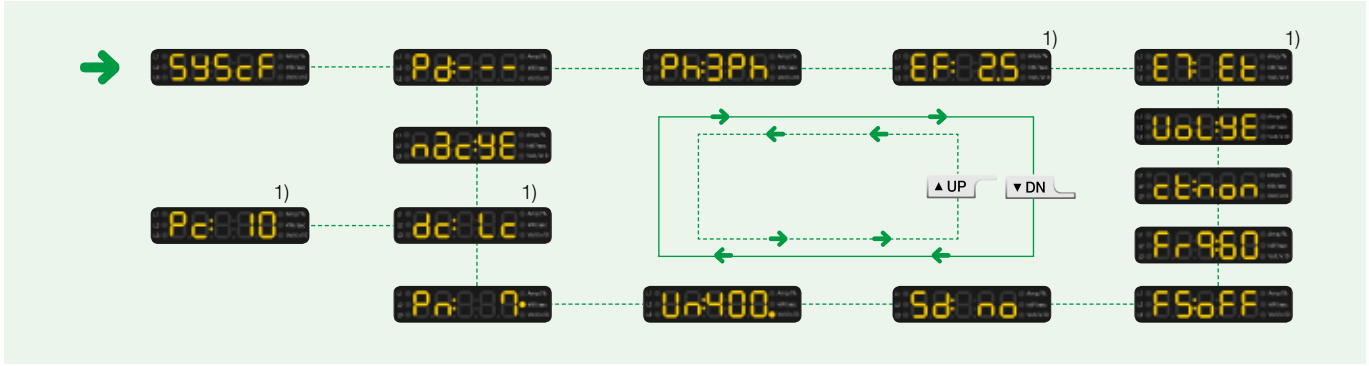
※ *Fault History View: In Fault History View mode, you can check the fault history, from the most recent fault to the oldest fault. While checking the history, the most recent fault cause, fault current, and fault phase will be displayed. Every time you press the DN button, the values for L1, L2, L3, (earth fault current), L1-L2, L2-L3, L3-L1 will be displayed, in this order. To check the previous fault history, press the DN button again. While the fault history is being displayed, a bar graph will show the display info of the most recent fault only on the 100% LED. The display info of the next-most-recent fault will be displayed on the two LEDs of 95% and 100%, and for the third-most-recent fault info, all three LEDs of 90%, 95%, and 100% will show the fault info. If you press ESC briefly while viewing the fault history, it will switch to the circulation display of current and voltage. If you press the UP or DN button, among the LEDs of L1, L2, and L3 on the left side, the LED of the corresponding phase will display the fault current on the left side. For all other displays, the fault item info will be displayed as well. The history of up to 3 faults is saved, with the oldest history overwritten by a new fault when it occurs.*

Mode Setting Sequence

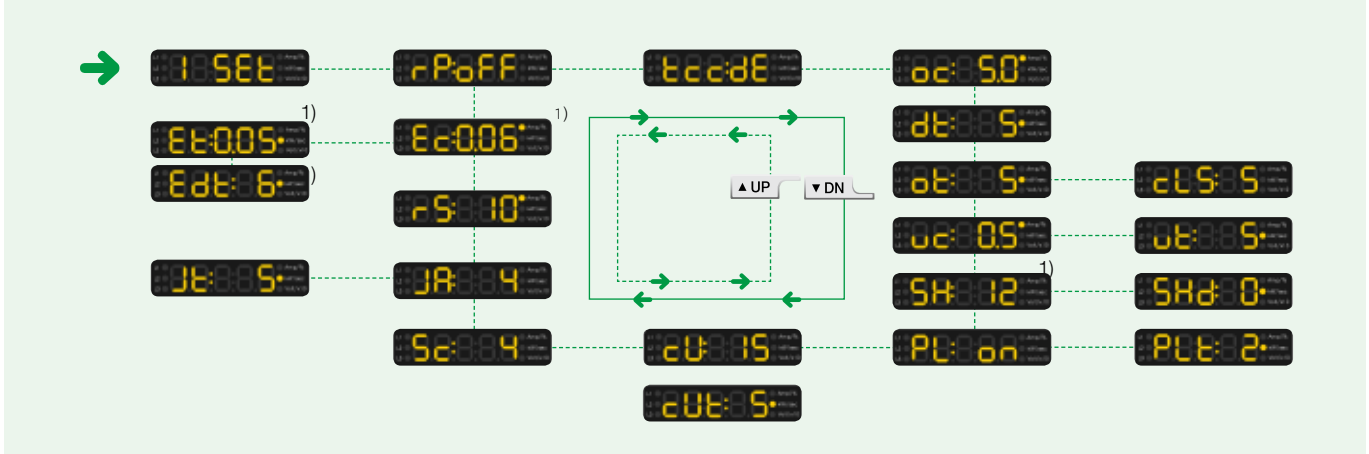
1. Main Mode Setting Sequence



2. Sub Mode Sequence: System Related Mode



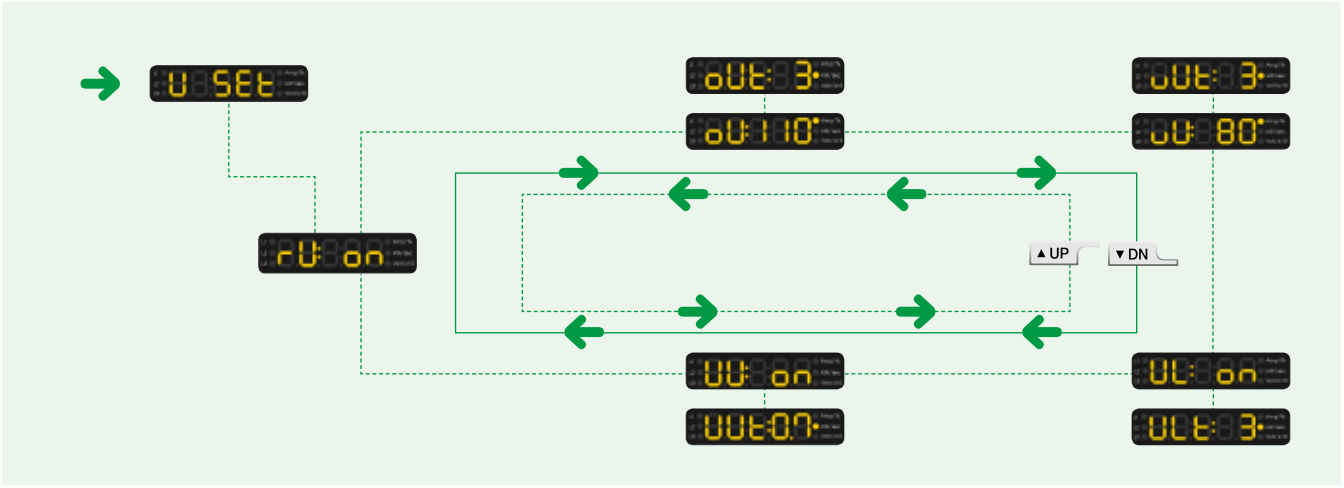
3. Sub Mode Sequence: Current Related Mode



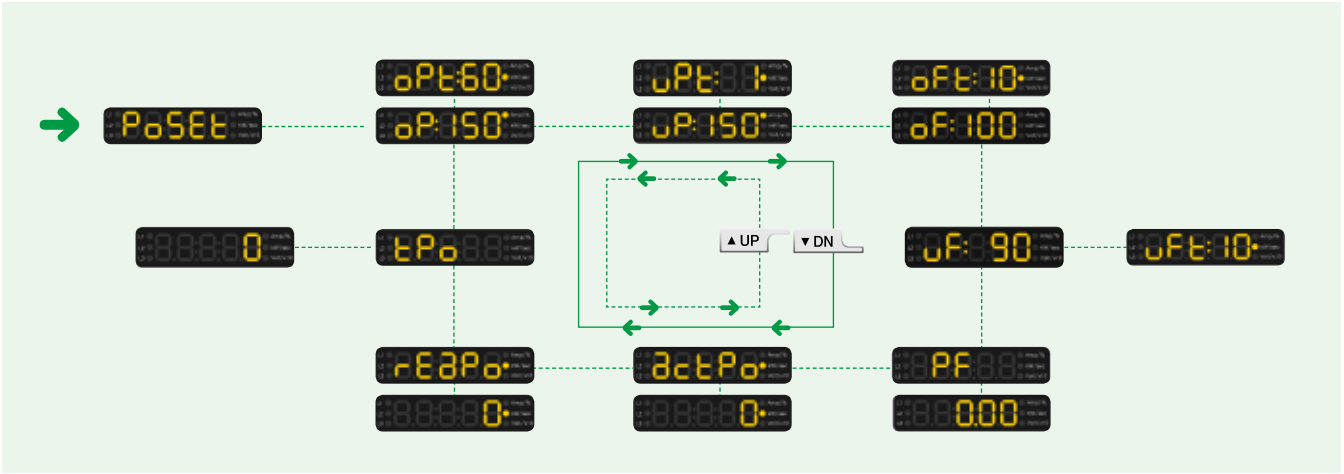
1) This function is not available in iSEMD products.
2) This function is not available in iSEMZ products

Mode Setting Sequence

4. Sub Mode Sequence: Voltage Related Mode



5. Sub Mode Sequence: Current Related Mode



1) This function is not available in iSEMD products.
2) This function is not available in iSEMZ products

Function Setting Sequence and Setting Menu

System Related Setting Item (SYSCF menu): Can be set only when the motor is not running.
During operation, you can only check the set values.

Sequence	Setting Item	Display	Description	Setting Range	Default	Unit
1)	Password	Pd:---	Sets password to prevent operators other than the manager from changing certain set values; when set to "000", no password is set.	000~999	---	
2)	3-phase/Single-phase Selection	Ph:3Ph	3-phase or Single-phase selection mode	1Ph, 3Ph	3Ph	
3)	Earth Fault Current Setting Range Selection *1)	EF: 2.5	Earth fault current setting range selection mode If "EF:2.5" is selected, the value can be set from 0.03 to 2.5A. If "EF:10" is selected, the value can be set from 1 to 10A	2.5, 10	2.5	
4)	Earth Fault Current Protection Selection *1)	Et: In	Earth Fault Current Protection Select Mode For "ET:In", use Internal ZCT. Internal ZCT cannot be used for External CT; External ZCT should be selected in that case.	In, Et	In	
5)	Voltage Wiring Selection	Vol:YE	Voltage wiring selection mode If you have wired the voltage input, select "Vol:Ye". If not, select "Vol:no" . If you do not wire the voltage wiring (including electrical energy), the related info will not show up	YE, no	YE	
6)	External CT Ratio Setting	ct:non	If the current is 100A or higher for Definite and 60A or higher for Inverse, an external CT must be used, and this setting ratio indicates the primary current of the external CT.	non, 2t, 3t, 4t, 5t, Cus (ct:10~800)	non	
7)	System Voltage Frequency Selection	Fr:60	Selection mode for the frequency of system voltage	50, 60	60	
8)	Fail Safe Function Selection	FS:oFF	If the control power is supplied while using Fail Safe function, OL (OverLoad) output contact will switch from a to b and from b to a, and it will return to the original phase when tripped.	oFF, on	oFF	
9)	Star-Delta Motor Usage Selection	Sd: no	If the motor is set to start with the Star-Delta setting, this function determines the state as 'operation in progress' even if the current falls to the oFF level or below while switching from Star to Delta.	YE, no	no	
10)	Motor's Rated Voltage Setting	Un:400.	Motor's rated voltage setting mode	110~690	440	Volt/x10
11)	Motor Rated Capacity Setting	Pn: 7.5	Mode to set the motor's rated capacity	0.01~655	7.5	kW/sec
12)	DC Output Selection *1)	dc: Lc	Use 4~20mA analog output with dc:Lc selected; Use Metering pulse output of the electric energy with dc:PS selected	Lc, PS	Lc	
13)	Metering Pulse Value Setting*1)	Pc: 100	Mode to set the metering pulse value Can be set when selecting dc:Ps for DC output.	100, 200, 500, 1000, 5000, 9000	100	
14)	Network Write Permission Selection	nAc:YE	Assign write permission of the set value through the network	YE, no	No	

Voltage related setting items (U SEt menu): If it is disabled in the voltage protection selection (noUno) menu, all voltage-related setting menus will disappear.

Sequence	Setting Item	Display	Description	Setting Range	Default	Unit
1)	Reverse Phase Protection Selection	rU: on	Mode to select the reverse phase protection function Applies only when motor has started	on, oFF	oFF	
2)	Over Voltage Setting	oU: 110	Mode to set the over voltage value, in the form of a percentage (%) Sets as a percentage (%) of the nominal voltage (110~690V)	oFF, 101~115	oFF	AMP/%
3)	Over Voltage Operation Time	oUt: 3.	Mode to set the over voltage operation time Cannot be set if oV:oFF is selected for over voltage set value	0.2~30	3	kW/sec
4)	Under Voltage Setting	uU: 80	Sets the under voltage value in the form of a percentage (%) Sets as a percentage (%) of the nominal voltage (110~690V)	oFF, 70~99	oFF	AMP/%
5)	Under Voltage Operation Time	uUt: 3.	Mode to set the under voltage operation time Cannot be set if uV:oFF is selected for under voltage set value	0.2~30	3	kW/sec
6)	Select Phase Loss Protection	UL: on	Mode to select the voltage phase loss protection function	on, oFF	oFF	
7)	Phase Loss Operation Time	ULt: 3.	Mode to set the voltage phase loss operation time Cannot be set if VL:oFF is selected for phase loss protection	0.1~30	2	kW/sec
8)	Unbalance Factor Setting	UU: on	Unbalance factor = (max. difference between phase-to-phase voltage and average phase-to-phase voltage) / (average phase-to-phase voltage) x 100 %	oFF, 3~15	oFF	
9)	Unbalance Operation Time	UUt:0.5	Mode to set the voltage unbalance operation time	0.2~20	5	kW/sec

Current related setting items (I SEt menu)

Sequence	Setting Item	Display	Description	Setting Range	Default	Unit
1)	Select Reverse Phase Protection	rPoFF	Mode to select the reverse phase protection function Applied only when the motor has started.	on, oFF	oFF	
2)	Select Overload Detection Method	tcc:dE	Mode to select the overload detection method If tcc:no is selected, the over current protection function is ignored. If tcc:dE is selected, the Definite protection characteristic is used. If tcc:In is selected, the Inverse protection characteristic is used. If tcc:th is selected, the Thermal Inverse protection characteristic is used.	no, dE, In, th	dE	
3)	Over Current Setting	oc: 5.0	Mode to set the over current value Can be set from 0.5~100A for Definite and 0.5~60A for Inverse/ Thermal Inverse.	dE: 0.5~100| In/th: 0.5~60	5	AMP/%
4)	Start Delay Time	dt: 5	Mode to set delay time to prevent a trip from being caused by starting current of motor. During this time period, the functions such as over current, under current, Stall, and Jam are all suspended.	0~600	5	kW/sec
5)	Over Current Operation Time	ot: 5	Mode to set the over current operation time	0.2~120	5	kW/sec
6)	Inverse/Thermal Inverse Select Characteristic Curve	cLS: 5	Mode to set the characteristic curve of Inverse or Thermal Inverse Can be set if tcc:In or tcc:th is selected as an overload detection method.	1~30	5	
7)	Under Current Setting	uc: 05	Mode to set the under current value Setting it to over current (oc:xxx) or higher is not allowed	oFF, 0.5~oc set value or less	oFF	AMP/%
8)	Under Current Operation Time	ut: 5	Mode to set the under current operation time Cannot be set if uc:oFF is selected for the under current set value	0.5~120	5	kW/sec
9)	Short-circuit Current Setting *1)	SH: 12	Mode to set the short-circuit current value Operates if an earth fault current higher than the set earth fault current is detected. (SH value can be set when oc × SH <= 500A or less.)	oFF, 2~50	oFF	
10)	Short-circuit Current Operation Delay Time*1)	SHd: 0	Mode to set the short-circuit current operation delay time The short-circuit current operation delay time that was set will only apply when the motor starts. Cannot be set if SH:oFF is selected for the short-circuit current set value.	0~20	0	kW/sec
11)	Select Phase Loss Protection	PL: on	Mode to select the current phase loss protection function	on, oFF	oFF	
12)	Phase Loss Operation Time	PLt: 2	Mode to set the current phase loss operation Cannot be set if PL:oFF is selected for phase loss protection	0.5~5	2	kW/sec
13)	Unbalance Factor Setting	cU: 15	Mode to set the current unbalance in percentage (%) Unbalance factor = (max. phase current - min. phase current) / max phase current × 100%	oFF, 10~50	oFF	
14)	Unbalance Operation Time	cUt: 5	Mode to set the current unbalance operation time Cannot be set if cV:oFF is selected for the unbalance factor set value	1~10	5	kW/sec
15)	Stall Current Setting	Sc: 4	Stall set as a multiple of the over current set value (oc:xxx) starts operating within 0.5 sec after the delay operation time (D-Time) is over. This mode does not show up when D-Time is 0. (Sc value can be set when oc × Sc <= 500A or less.)	oFF, 2~8	oFF	
16)	Jam Current Setting	JA: 4	Jam is set as a multiple of the over current set value (oc:xx), and protects the motor if there is a rapid load increase during operation. (Sc value can be set when oc × JA <= 500A or less.)	oFF, 1.5~8	oFF	
17)	Jam Operation Time	Jt: 5	Mode to set the Jam current operation time Once set, the Jam operation time will only be applied when the motor is operating. Cannot be set if JA:oFF is selected as the Jam current set value.	0.2~10	5	kW/sec
18)	4~20mA Output Setting *1)	rS: 10	Mode to set the output of 4~20mA with range setting 20mA output is generated if the current flowing in EOCR is detected as being over the Range Setting set current, and 4mA output is generated under the minimum detected current of 0.4A or less.	0.5~100	oFF	Amp/% Volt/X10
19)	Earth Fault Current *1)	Ec:0.06	Mode to set the earth fault current value Inspects the insulation of the circuit or the unique leakage current contained within the motor itself after the installation, and sets the current which has been identified as having no faults. The earth fault current that was set indicates ZCT primary earth fault current.	oFF, 0.03~2.5 (when EF:2.5 is selected) oFF, 1.0~10A (when EF:10 is selected)	oFF	AMP/%
20)	Earth Fault Current Operation Time *1)	Et:0.05	Mode to set the earth fault current operation time Earth fault operation time range will automatically change based on whether you select Internal ZCT or External ZCT. Cannot be set if Ec:oFF is selected as the earth fault current set value.	0.05~10s (when ET:In is selected) 0.1~10s (when ET:Et is wselected)	1	kW/sec
21)	Earth Fault Current Operation Delay Time *1)	Edt: 6	Mode to set the earth fault current operation delay time The earth fault current operation delay time that was set will only apply when the motor has started. Cannot be set if Ec:oFF is selected for the earth fault current set value.	0~30	0	kW/sec

Auxiliary Functions and Communication Related Setting Items

Sequence	Setting Item	Display	Description	Setting Range	Default	Unit
1)	Alert Output Setting	ALo:A	Indicates Ampere Relay. When current is detected, 07-08 output contacts close, but open when there is no current.	A, F, H, to, uc, In, Mc, Vo, Po, no	no	
		ALo:F	Indicates Flickering, which means that if you attach a light on the output contact, the light will flicker and if the current higher than the alert setting (%) flows, Close↔Open will be repeated.			
		ALo:H	Indicates Holding. In this output, if the current higher than the alert setting (%) flows, the output contact is closed, but if the current is below the alert setting (%), the contact is opened.			
		ALoto	Indicates Time Out. If set when the Running Hour of the motor is set and the time set from rh:xx is passed, the output contact will repeat the process of closing for 1 second and opening for 1 second, which serves as a signal to indicate that time has passed.			
		ALouc	Output for using the operation of under current; the output contact is closed if under current occurs. If you select a different alert output, the contact will not close even if under current occurs.			
		ALoIn	Setting to be used for insulation diagnostic output. If this value is equal to or less than the reference resistance value when the insulation diagnostic test is over, the output contact will be closed. *1), 2)			
		ALonc	Indicates the number of times the electromagnetic contactor has been operated. If it reaches or exceeds the set number of operations, the contact will be closed.			
		ALoUo	A contact for using the voltage output. The contact will be closed when operated.			
		ALoPo	A contact for using the power output. The contact will be closed when operated.			
		ALono	The alert output will not be used when this mode is selected.			
2)	Alert Setting	AL:50	Indicates the alert setting, and is set as a percentage (%) of the over current setting. If current that is equal to or greater than the set percentage(%) is detected, 07-08 terminals will generate output based on the alert output (ALo:xx) setting. Can be set if ALo:F or ALo:H is selected for alert output set value.	50~100	50	
3)	Fault Reset Setting	rtE-r	Indicates electric reset. It is also called 'remote reset' because the fault can be reset remotely by means of resetting when the control power of EOCR is cut.	E-r, H-r, A-r	E-r	
		rtH-r	Indicates manual reset, enabling a reset simply by pressing the Reset and sPDM ESC buttons. Used when trip cause check and reset are required.			
		rtA-r	Indicates auto reset. Auto reset occurs if EOCR is operated and the set auto reset time (A-r) has passed.			
4)	Auto Reset Time	Ar:5	Mode to set the auto reset time, which can only be set when auto reset (r-t:A-r) is selected for the fault reset setting.	0.5~20n	5	
5)	Restart Limit Setting	rnoFF	Can be set if rt:A-r is selected as the fault reset value. Restart limit can be set if auto reset (rt:A-r) is selected for the fault reset setting, and is used to prevent excessive heat accumulation by limiting the number allowed for restart in 30 minutes. Can be set if rt:A-r is selected as the fault reset set value.	oFF, 1~5	oFF	
6)	Cumulative Total Operation Time	-trh-	If there is current flow that exceeds the min. perception current after installing EOCR, the operating time is accumulated for integration of up to a total of 99,999 hours. The min. display time is presented in units of 1 hour. The cumulative total operation time cannot be deleted or modified. The cumulative total operation time can be checked through "-trh- ↔ 0.0" by pressing the SET button	0~99999	0	
7)	Display of Cumulative Operation Time	--rh-	Motor's operation time is repeatedly displayed, and when set to rh:oFF if the motor stops, the operation time is deleted. If it is reset, the operation time is accumulated. The cumulative operation time can be checked through "-trh- ↔ 0.0" by pressing the SET button	0~99999	0	
8)	Cumulative Operation Time Alert Output Setting	rh:10	Mode to set the cumulative operation time alert output If the set time passes when set to ALo:to, the output is generated through 07-08 contacts. If set to 0, the cumulative operating time is deleted.	0~9990	0	
9)	Year Setting	Yr:12	Mode to set the year	09~99	12	
10)	Month Setting	Mon:8	Mode to set the month	1~12	11	
11)	Date Setting	dd:31	Mode to set the date	1~31	1	
12)	Hour Setting	hh:6	Mode to set the hour	00~23	1	
13)	Minute Setting	Mn:40	Mode to set the minute	00~59	40	
14)	Second Setting	SEc:33	Mode to set the second	00~59	39	
15)	Slave Address Setting	Ad:1	Mode to set the Modbus slave address	1~247	1	
16)	Communication Speed Setting	bP:192	Mode to set the communication speed The communication speed is displayed as follows: 12: 1.2kbps, 24: 2.4kbps, 48: 4.8kbps, 96: 9.6kbps, 192: 19.2kbps, 384: 38.4kbps	12, 24, 48, 96, 192, 384	192	
17)	Parity Setting	PrEun	Mode to set the communication parity If pr:no1 is selected, the stop bit becomes 2. If the remaining pr:non, pr:Eun, or pr:odd is selected, the stop bit becomes 1.	non, no1, Eun, odd	Eun	
18)	Communication Loss Detection Time	LtoFF	Indicates communication Time Out. If there is no data request from the host within the communication detection time, it will be considered as a loss of communication, and a warning will be generated.	oFF, 1~999	oFF	

Sequence	Setting Item	Display	Description	Setting Range	Default	Unit
19)	Fault Information Cause Check	FAULT	Mode to check the fault information cause The fault information cause can be checked for up to 3 records.	3 records		
20)	PDM Connection Status Check Setting	hLSno	Mode to check the connection status of the display device (sPDM). When YE is selected, it will be tripped if the communication for main body and sPDM are interrupted for 7 seconds or more.	YE, no	no	
21)	Inner Thermal Capacity Value Reset Setting	CLrth	Mode to reset the inner thermal capacity value Reset setting can be enabled by pressing the SET button → clr:th (flickering) → SET button.	th	th	
22)	Mc Operation Count Setting	ncSEt	If Mc operation count is set and the count of Mc operation reaches or exceeds the set value, it can be used as a pre-alarm through the output contacts (07-08). indicates 1000 (a thousand). When clr is selected, the count saved is reset.	clr, 1000~9990000	clr	
23)	Mc Operation Count View	ncCnt	When selecting Mc operation number with view menu, detected Mc operation count is shown.			
24)	Display Mode Selection	dSP:1	If mode 1 is selected for circulation display setting, voltage, current, and power are displayed. If mode 2 is selected, only voltage and power are displayed.	1, 2	1	
25)	Output Contact Test	tESt	This can only be used when the motor has stopped running. If this mode is selected, tESt starts to flicker, counts down the set O-Time after 3 seconds, displays the End message, and the status of output will be provided in a trip status. By pressing ESC, you can go back to the current display. If the motor is operating, this mode will not be displayed in order to prevent a trip.			
26)	Reference Insulation Resistance Value Setting *1) *2)	rL:10n	Mode to specify the reference insulation resistance value of the motor	1MΩ, 5MΩ, 10MΩ	10MΩ	
27)	Insulation Resistance Test *1) *2)	InS	Mode to diagnose the insulation resistance of the motor A diagnosis can only be performed when the motor is not running. When this option is selected, the diagnosis begins. After counting down for 60 seconds, it reports if the value is higher or lower than the set reference value (1MΩ, 5MΩ, 10MΩ). If In is selected for the alert output setting (see Alo setting), the test result can be received through 07-08 contacts as well.			

Power Related Item and Measurement (PoSEt menu): When 'no wiring' is selected from the voltage wiring select (VoLtyE) menu, all settings menus relating to power disappear.

Sequence	Setting Item	Display	Description	Setting Range	Default	Unit
1)	Overpower Setting	oP:150	Sets the overpower value in the form of a percentage (%) Sets as a percentage (%) of the rated capacity (0.01~999kW).	oFF, 20~800	oFF	AMP/%
2)	Overpower Operation Time	oPt:60	Mode to set the overpower operation time Cannot be set if oP:oFF is selected for the overpower set value.	1~100	60	kW/sec
3)	Low Power Setting	uP:150	Sets the low power value in the form of a percentage (%) Sets as a percentage (%) of the rated capacity (0.01~999kW).	oFF, 20~800	oFF	AMP/%
4)	Low Power Operation Time	uPt:1	Mode to set the low power operation time Cannot be set if uP:oFF is selected for the low power set value.	1~30	1	kW/sec
5)	Overpower Factor Setting	oF:100	Mode to set the overpower factor value	oFF, 0-100	oFF	
6)	Overpower Factor Operation Time	oFt:10	Mode to set the overpower operation time Cannot be set if oF:oFF is selected for the overpower factor set value.	2~30	10	kW/sec
7)	Underpower Factor Setting	uF: 90	Mode to set the underpower factor value	oFF, 0~100	oFF	
8)	Underpower Factor Operation Time	uFt:10	Mode to set the underpower operation time Cannot be set if uF:oFF is selected for the underpower factor set value.	1~30	10	kW/sec
9)	Power Factor (PF) Display	PF	Displays the motor's power factor (cannot be modified) By pressing the SET button, the power factor value can be checked in "PF ↔ 0.00".	0.00~1.00	0	
10)	Active Power (kW) Display	actPo	Displays the motor's active power (cannot be modified) By pressing the SET button, the active power value can be checked in "actPo ↔ 0".		0	kW/sec
11)	Reactive Power (kVar) Display	tPo	Displays the motor's reactive power (cannot be modified) By pressing the SET button, the reactive power value can be checked in "rEaPo ↔ 0".		0	kW/sec
12)	Active Energy (kWh) Display	rEaPo	Displays the motor's total active energy (cannot be modified) By pressing the SET button, the active energy value can be checked in "tPo ↔ 0".		0	

**1) This function is not available in iSEMD products.*
**2) This function is not available in iSEMZ products.*

Trip Cause Display and Check Method

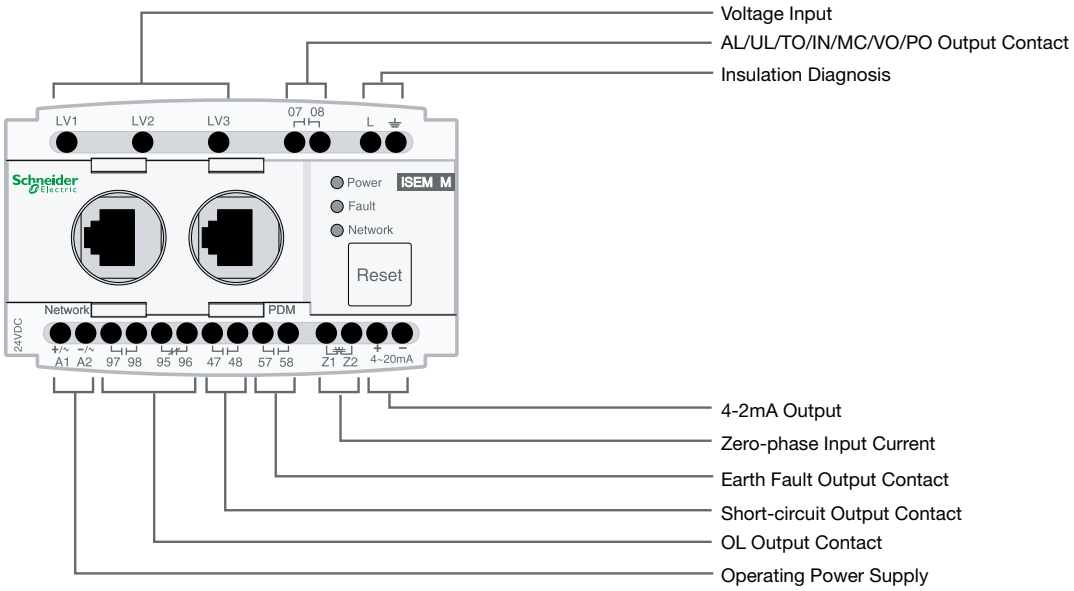
Once EOCR is tripped, the cause of the trip and the current, voltage, or energy are displayed, and the last 3 trip causes and the current, voltage, and time at each phase at the time of the trips are saved. This means that it is possible to check them in the Fault mode. Trip causes can be checked regardless of the motor's status, i.e. whether it is operating or not.

Trip Cause	Fault Status Display	Fault Cause Display Description
Over Current		Tripped by detecting over current of 3.5A at L1 phase while operating
Under Current		Tripped by detecting under current of 1.5A at L3 phase while operating
Current Phase Loss		Tripped by detecting phase loss at L1 phase
Current Unbalance		Tripped by detecting an unbalance due to a current deviation at L3 phase
Stall		Tripped by detecting burden current of 45A at L1 phase while operating
Jam		Tripped by detecting burden current of 35A at L2 phase while operating
Leakage Earth fault *1)		Tripped by detecting earth fault current of 0.15A
Short-circuit *1)		Tripped by detecting short-circuit current of 60A at L3 phase
Current Reverse Phase		Tripped by detecting current reverse phase during start-up
Over voltage		Tripped by detecting over voltage of 390V between L1 and L3 phases during operation
Under Current		Tripped by detecting under voltage of 210V between L2 and L3 phases during operation
Voltage Phase Loss		Tripped by detecting phase loss due to a phase-to-phase voltage deviation at L1-L2
Voltage Unbalance		Tripped by detecting unbalance due to a phase-to-phase voltage deviation at L1-L2
Voltage Reverse Phase		Tripped by detecting voltage reverse phase
Overpower		Tripped by detecting overpower of 350kW during operation
Low Power		Tripped by detecting low power of 150kW during operation
Overpower Factor		Tripped by detecting an overpower factor of 0.99 during operation
Low power factor		Tripped by detecting a low power factor of 0.55 during operation
PDM Communication Loss		Tripped because communication with PDM has been lost
Network Communication Interruption		Tripped because network communication with Modbus has been lost
Faulty Button		Tripped due to a faulty Reset button on the main body
External Fault		Tripped after receiving a fault signal through network communication
Auto Reset Limit		Tripped because the count of auto reset attempts within 30 minutes has exceeded the set number
Internal Fault		Tripped due to an internal fault
Test Completed		Tripped when a test is completed

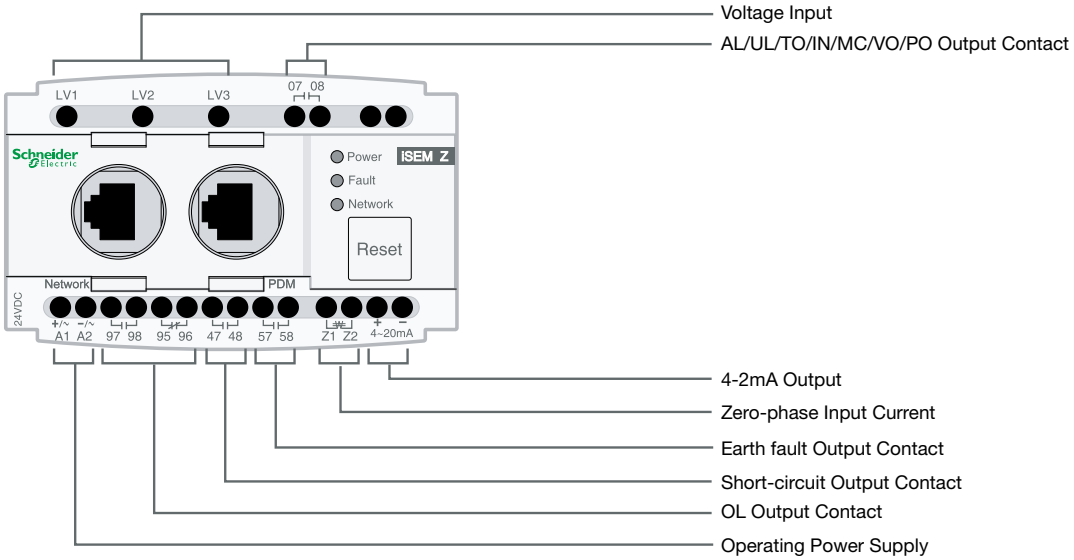
**1) This function is not available in iSEMD products.*

I/O (Input/Output) Terminal Diagram

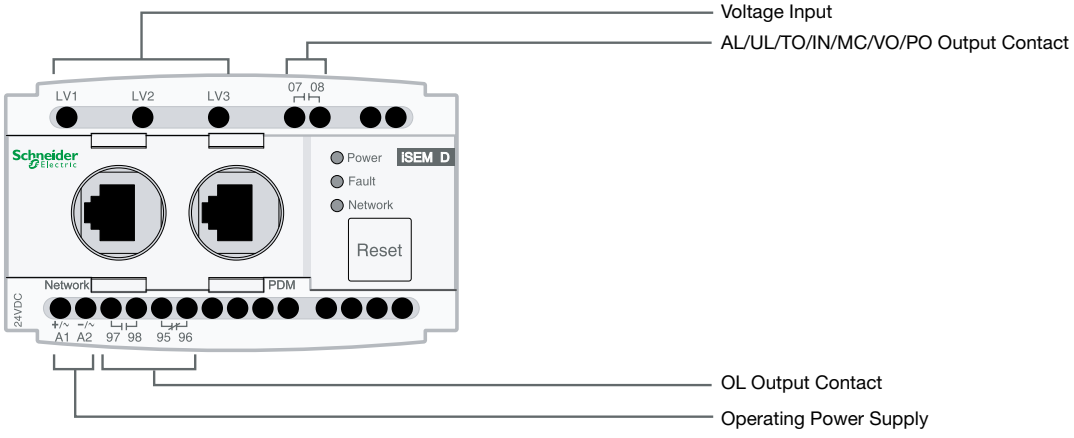
• ISEMM-xxxxx



• ISEMZ-xxxxx

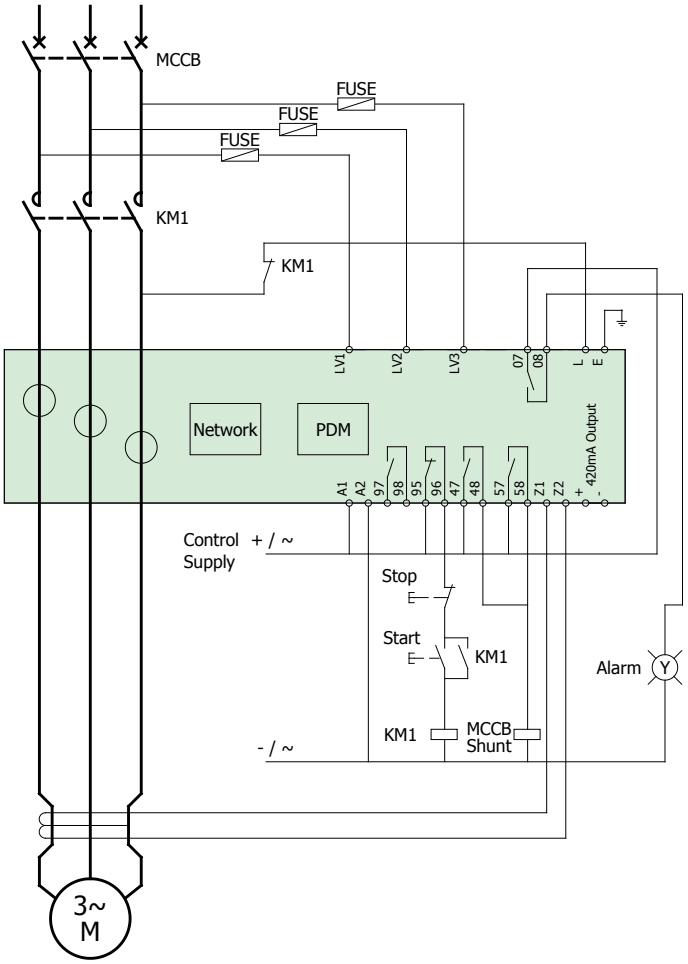


• ISEMD-xxxxx



Wiring Example Diagram

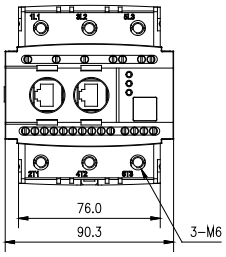
Direct On Line (DOL) Starter

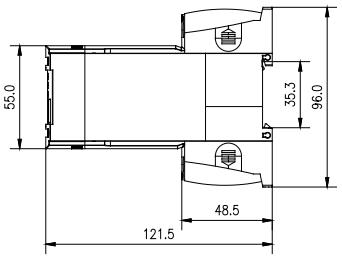


※Use an insulated power supply for the control power.

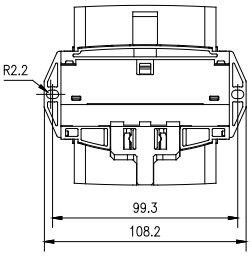
Dimensions Diagram

iSEM-xxxT



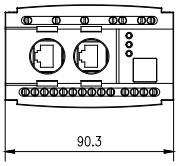


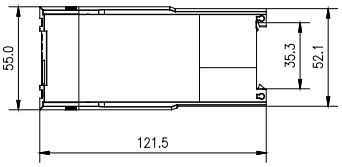
PANEL & DIN RAIL TYPE



MOUNTING HOLE SIZE

iSEM-xxxH





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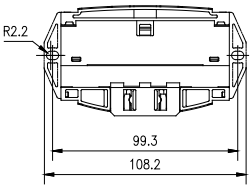
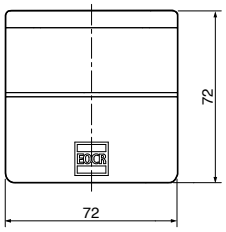
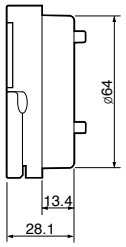
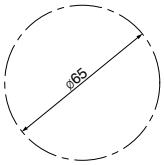


MOUNTING HOLE SIZE

Dispaly
EOCR-sPDM







How to Order

To order an EOCR-iSEM:

I S E M M – W R U H
❶ ❷ ❸ ❹

❶	**Product Type**	**MD**	Electric Energy + Standard
		MZ	Electric Energy + Earth Fault Protection
		MM	Electric Energy + Earth Fault Protection + Insulation Resistance Diagnosis
❷	**Current Range**	**WR**	0.5~100A
		H1	100:5A 3CT Combination
		HH	150:5A 3CT Combination
		H2	200:5A 3CT Combination
		H3	300:5A 3CT Combination
		H4	400:5A 3CT Combination
❸	**Operating Power Supply/Frequency**	**B**	DC 24V
		U	AC 100~240V 50/60Hz)
❹	**CT Format**	**H**	Bottom Hole
		T	Terminal

To order an RJ45 Cable:

C A B L E – R J 4 5 – 0 0 1
❶ ❷

❶	**Cable Connection Specifications**	**RJ45**	
❷	**Cable Length**	**00H**	0.5M
		1	1M
		01H	1.5M
		2	2M
		3	3M
		Other	Order Specifications (Up to 150M)